

<b>5<sup>th</sup> Semester</b>	<b>RBM5D005</b>	<b>Bioprocess Engineering</b>	<b>L-T-P 3-0-0</b>	<b>3 Credits</b>
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**Module I**

Media Preparation, Media design and optimization. Microbial growth patterns and kinetics in batch culture, Microbial growth parameters, Environmental conditions affect growth kinetics, Kinetics of thermal death of microorganisms, Heat Generation by microbial growth, Quantitative analysis of microbial growth by direct & indirect methods.

**Module II**

Sterilization: concept and methods. Type of Sterilizations, Batch heat sterilization of liquids, Estimation of sterilizer efficiency, Continuous heat sterilization of liquids, Sterilization of air: Methods & Mechanism, Design of depth filter and estimation of its efficiency. Stoichiometric calculations, Theoretical prediction of yield coefficients, Stoichiometry of growth and product formation, Maximum possible yield, Theoretical oxygen demand, Stoichiometry of single-cell protein synthesis.

**Module III**

Ideal Reactor Operation: Batch, Fed Batch & Continuous operation of mixed bioreactors, Microbial pellet formation, Kinetics and dynamics of pellet formation. Chemostate with immobilized cells, Chemostate with cell recycle, substrate utilization and product formation in bioreactor, Scale up of Bioreactors

**Module IV**

Role of diffusion in Bioprocessing, Convective mass transfer, Gas-liquid mass transfer, Oxygen uptake in cell cultures, Factor affecting cellular oxygen demand, Oxygen transfer in bioreactors, Measurement of volumetric oxygen transfer coefficient, Oxygen transfer in large bioreactor.

**Module V**

Bioreactor control mechanism, Physical, Chemical and Biological environment of bioreactor, Manual control system, Role of physical, chemical & biological sensors, Advanced control strategies viz. PID controllers, Fuzzy logic based controllers and artificial neural network based Controllers. Basic concepts of computer modeling and optimization in bioprocess applications.

**BOOKS**

1. Principles of Microbe and cell cultivation- S. John Pirt, Butterworth Publication.
2. Bioprocess Engineering Principles – P. M. Doran, 5th ed.
3. Hand Book Of Bioengineering- Skalak R & Shu Chien, 4th ed.
4. Biochemical Engg. Bailly & Ollis, Academic Press
5. Introduction to Chemical Engg. Series, MCH Int. Series.
6. Biochemical & Biological Engg. Science, N. Blakebraugh, Academic Press